

ON THE
PREVENTION AND TREATMENT
OF THE
SHEFFIELD GRINDERS' DISEASE.

BY

J. C. HALL, M.D.,

PHYSICIAN TO THE SHEFFIELD PUBLIC DISPENSARY.

AUTHOR OF "HINTS ON THE PATHOLOGY, DIAGNOSIS, PREVENTION, AND
TREATMENT OF CONSUMPTION", ETC. ETC. ETC.

With Six Illustrations.

LONDON:
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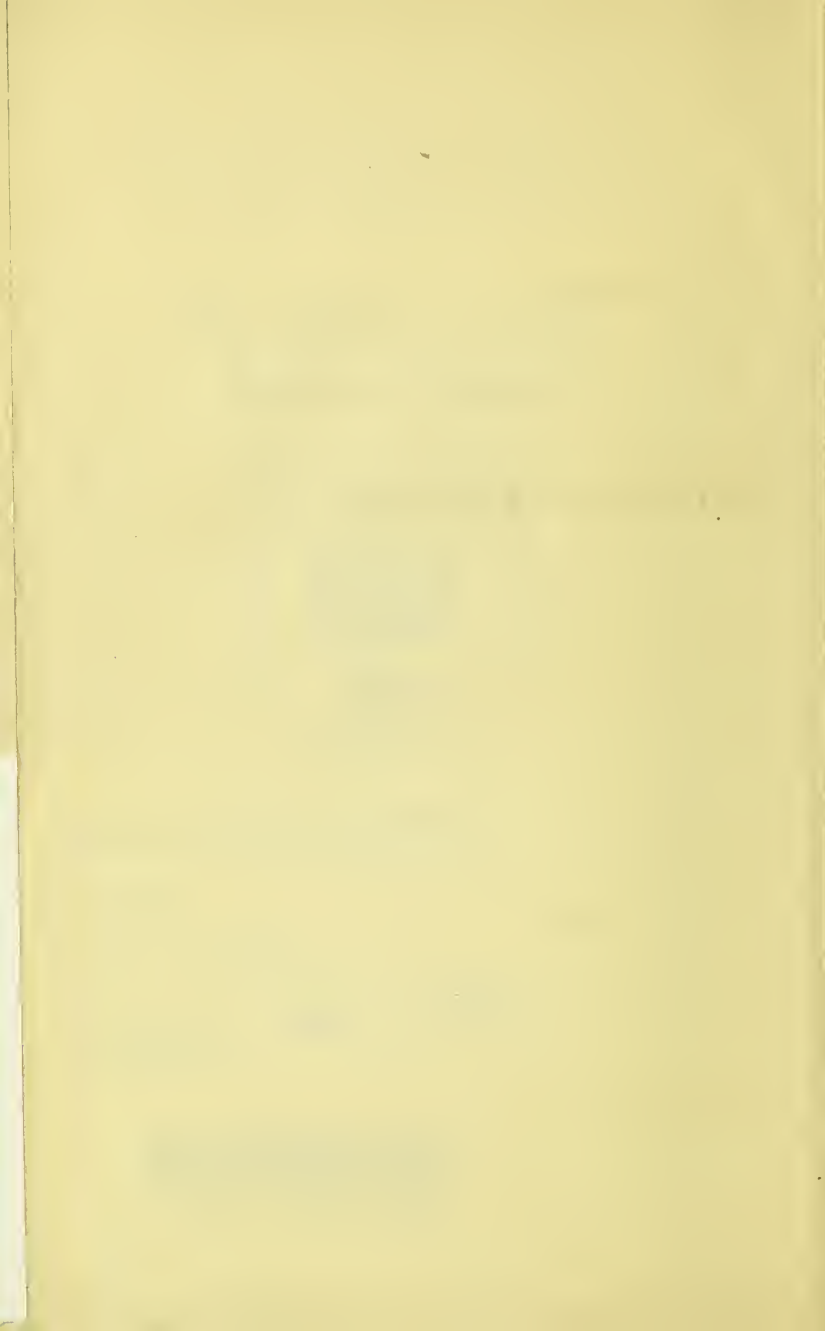
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TO THE
PHYSICIANS AND SURGEONS
OF THE
SHEFFIELD PUBLIC DISPENSARY,

THESE PAGES ARE DEDICATED

BY THEIR FAITHFUL FRIEND AND COLLEAGUE,

THE AUTHOR.

SURREY HOUSE, SHEFFIELD,

April 29th, 1857.



THE SHEFFIELD GRINDERS.

IN commencing the first of a series of papers for the BRITISH MEDICAL JOURNAL, on the Diseases of Artisans, I shall endeavour, whilst treating of the peculiar disease induced in Sheffield by the calling of a *Grinder*, to give a general description of the habits of these men, the numbers employed in the various branches of grinding, the average ages of those now living, and other particulars of general interest with regard to the town of Sheffield and its geological position; for I quite agree with the editor of that JOURNAL, that these articles will derive no little portion of their interest from containing faithful sketches of the various peculiarities found in the towns which form the homes of those industrious workers in the hives of British enterprise, together with an account of the social and industrial conditions which lead to the diseases of artisans. Of course the Sheffield grinders are liable to various affections, like other men; and to the depressing influences on the animal economy which exist in all large towns; but, when speaking of the diseases of the Sheffield artisans,* I intend to treat only of those which arise in consequence of the occupations in which they are engaged. Our investigations will, I think, be facilitated by directing attention to—

- A. The Town of Sheffield, and the Manufactures carried on in it.
- B. The Sheffield Grinders, and the Nature of their Occupation.
- C. The Grinders' Disease.

* After I have finished the diseases of grinders, I intend to communicate a paper on the diseases of file cutters, etc.

A. THE TOWN OF SHEFFIELD, AND THE MANUFACTURES CARRIED
ON IN IT.

Sheffield is the principal seat of cutlery and other hardware manufacture, and the capital of the parish which bears its name, as well as of the ancient but not very clearly defined liberty of Hallamshire. It covers for a considerable extent the abrupt declivities and hills near the conflux of the rivers Sheaf and Don. Its canal opens a communication with the river Don, and other navigable rivers and canals; and its various railways afford a transit for passengers and goods to all parts of the kingdom. "Where now", says the historian of Hallamshire (the Rev. Joseph Hunter, F.R.S.), "is collected a numerous and active population, was anciently a deep solitude, the silence of which was broken only by our rivers pouring their waters in natural cascades through the woodland scenery. Who was the first to raise the axe amongst the forests of Hallamshire, or who first established himself and his family in one of its romantic valleys, it is now vain to attempt to recover."

The parish of Sheffield was unknown as one of the ecclesiastical subdivisions of the diocese of York before the time of the Norman conquest: it now comprises three entire Saxon manors, and a considerable portion of a fourth.

Few places in England present a more wonderful contrast between what they were and what they now are, than the town of Sheffield. Wide indeed is the difference now, when compared with that memorable period (from 1570 to 1584) when the unhappy Mary Queen of Scots was for so many years a prisoner, in the custody of the Earl of Shrewsbury, at Sheffield Castle; or when the Governor of Sheffield, Major Beaumont, surrendered this strong fortress to the Parliamentary forces under General Crawford, after a gallant resistance, on the 11th of August, 1644.

TABLE I.

Townships.	Population in A.D.					No. of Acres.	Houses in 1851.
	1801.	1811.	1821.	1831.	1841.		
Sheffield	31,314	35,840	42,157	59,011	67,967	3436	16,943
Ecclesall	5,362	6,569	9,113	14,279	20,003	4180	5,194
Brightside	4,030	6,899	6,615	8,968	10,089	2680	2,517
Attercliffe	2,281	2,673	3,172	3,741	4,156	1336	1,001
Nether Hallam	1,974	2,384	3,200	4,658	7,275	1902	1,689
Upper Hallam	764	866	1,018	1,035	1,396	8836	304
Total	45,755	53,231	65,275	91,692	110,891	22,370	27,658

1856.—Houses occupied 32,472
 " unoccupied 1,568
 " building 989
 Total houses 35,029

The parish of Sheffield is of considerable extent; it is more than ten miles in length, and its average breadth is about three miles, with an area of rather more than 22,000 acres. It contains many populous villages and hamlets, in the centre of which stands the large town of Sheffield, from which the parish derives its name. The following table will at a glance show how the town has increased. In 1615, the population was only 2,207; and, in 1736, the township of Sheffield consisted of 2,152 houses, with a population of 9,695.

In 1856, the total population of Sheffield was 161,000. Since then there have been erected 1,307 houses; so that the exact number of houses in the six townships of Sheffield at this time is 36,366, and the population 164,000. The rateable value of the property in the borough of Sheffield is £366,394:15:8. The expenditure of the Sheffield Union, which includes the townships of Sheffield, Brightside, and Attercliffe, last year was £32,000; and of the Ecclesall Union, which includes Ecclesall, Upper Hallam, and Nether Hallam, £9,853:6.

Sheffield of late years has rapidly increased in size and importance, and recent enterprise has greatly added to the wealth of many of our merchants and manufacturers; although, as a rule, the large fortunes are not made in Sheffield that we hear of in Manchester and other towns. Many of our local trades can also be carried on with a very small amount of capital, and hence the very large number of what are called "little masters" in Sheffield. The wages of many of the artisans are also much higher than in other towns.

The neighbourhood of Sheffield abounds in the three mineral productions which are most important to man; namely, *iron*, *coal*, and *stone*. The iron ore is found in many parts of the district, at a depth of from fifty to sixty feet; and, although it was most unquestionably the presence of the "raw material" which first led the inhabitants of the town of Sheffield to manufactures of iron, these mines are comparatively, in this our day, of little importance to the staple branches of their trade. Steel is what

is principally required; and the native iron of the district is not adapted for conversion into steel, like the iron of other countries. About 32,000 tons of Swedish iron are annually imported into Sheffield, for the purpose of being converted into steel; and every year from ten to fifteen thousand tons of English iron are made into railway springs, etc. The iron obtained from the ore of the district is either used for castings or made into "rails", "merchants' bar", etc. What may be the effect of the process that has recently been patented by Mr. Bessemer, time alone can show; but we have evidence that foreign iron has been used in Sheffield for the last three centuries; and, in the accounts of the Church Burgesses of Sheffield for the year 1557, are the particulars of a payment to Robert Moore "*for one stone and qrter of Danske iron*", and for "*x lib. of Spanysch iron*".

Below the iron lies the bed of coal, one principal seam of which runs under a portion of the town. The mean depth of the coal is about 120 yards, and the thickness of the bed from three to five feet. This bed is a principal source of that large supply of fuel which the manufactures of Sheffield require, and has been so for many years. The existence of railways of late years has of course extended the sources whence the supply is obtained. Previous to the employment of coke, charcoal was used in the smelting of the iron ore, and doubtless led to the destruction of many of our ancient forests. Evelyn has remarked, that "Nature has thought fit to produce this wasting ore more plentifully in woodlands than in any other ground, and to enrich our forests to their own destruction."

A magnesian lime-stone, similar to that of which the Houses of Parliament are built, and which was obtained from the quarries at Anston, is found in the neighbourhood of Conisborough and Roche Abbey. Sheffield is built principally of red bricks, the clay for making which is found in almost every part of the parish. In every direction around Sheffield are quarries

of freestone, of various quality, which supply grind and mill-stones, flag-stones, and common roofing slate. Of the stones used for grinding, the greater part come from the neighbourhood of Wickersby and Dalton, about nine miles from Sheffield. These stones vary in size from twelve inches to the very large stones of seven feet diameter used in grinding saws. The "whitening" stones, used for smoothing articles before glazing, are brought from Brincliffe Edge Quarries, about a mile from the town.

In the early years of its history, the only extensive concerns connected with the trades of Sheffield were the furnaces and forges in which the iron was prepared for the use of the manufacturer; and the beautiful Park of Sheffield, in the midst of which stood the prison which so long held the Scottish queen, within the memory of man, was dotted with iron-stone "pit-hills". This land now is used for agricultural purposes, and hardly a trace of the mining operations remains visible. Sheffield did not enjoy in those times that almost entire monopoly it possesses at the present of the staple article of its manufactures—the *knife*. This country had an import trade in knives till the reign of Queen Elizabeth; and in the articles enumerated in the Custom-House books of the reign of Henry VIII (*British Bibliographer*), are *knives of Almayne*, *knyves of France*, and *knyves of Colloyne*. Stowe informs us that, in the fifth year of her reign, Queen Elizabeth laid some restrictions on this import trade, in order to encourage the London manufactures; London being at that time the principal mart for the finer species of cutlery. Now, it is notorious that a very large portion of what is sold as "fine London cutlery" in the metropolis, both scissors, knives, and razors, are

"Sheffield made,
Both haft and blade;"

the name of the London house being stamped upon them here.

The year 1742 is memorable in the history of Sheffield for the introduction of a new manufacture. Mr. Thomas Bolsover, an ingenious mechanic, when employed to repair the handle of a knife which was composed partly of silver and partly of copper, was struck with the possibility of uniting the two metals so as to form a cheap substitute, which should present the external appearance of silver, and therefore capable of being used in the manufacture of articles in which silver only had previously been employed. He confined himself to the manufacture of buttons and snuff-boxes, etc.; but Mr. Joseph Hancock, one of the Cutlers' Company, very soon showed that, by this new method, the finest and most elaborately embossed plate could be imitated. Birmingham very soon obtained a share in the new manufacture; but to the town of Sheffield belongs the honour of the invention, and the "Sheffield plate" is still highly prized for its elegance and durability.

The manufactures of Sheffield in cutlery—knives, scissors, razors; in files, edge tools, joiners' tools, scythes, sickles, shears, saws, circular saws, steel, railway springs, anvils, vices, stove-grates, fenders, fire-irons; silver, plated, and Britannia metal goods,—are celebrated throughout the world. At the great Exhibition of all Nations, held in the Crystal Palace, London, 1851, 12,000 square feet were covered with articles manufactured in Sheffield; and to the town, five council medals, and fifty-five prize medals, were awarded. At the great Exhibition held in Paris, Sheffield fully maintained its world-wide reputation for its manufactured articles in cutlery, edge tools, files, saws, etc.; and, in addition to numerous medals, a grand medal of honour was presented by the Emperor of the French, to the town of Sheffield, "for the superiority of its steel and hardware".

The town of Sheffield is supplied with water by a company, the total area of whose present reservoirs is $173\frac{1}{2}$ acres, and which contain, when full, 898,000,000 of gallons. These reservoirs are situated at Redmires and Rivelin. Very extensive

reservoirs are also in process of construction near Bradfield, which, when completed, will afford to the town of Sheffield a supply of 10,000,000 of gallons of water daily. The principal store reservoirs at present belonging to the company are at Redmires, seven miles from the town. These are placed at an elevation of 1,200 feet above the level of the sea, and are filled from springs, and from the surface drainage of the land. The quantity of rain water at such an elevation is always considerable. The water is brought along an open stone conduit to the other reservoirs of the company, which are placed about a mile from the town, and they are at an elevation of 460 feet above the lower streets; so that the water, which is conveyed in iron pipes to the town, can be easily taken to the upper rooms of the house of any inhabitant who may require it.

The water is very pure; and an imperial gallon does not contain more than four grains of mineral and organic matters. About a grain of these is in a state of suspension, and can easily be separated by filtration; and about three grains of saline, earthy, and organic matters, are held in solution. The taste is agreeable; and few towns have purer or better water than Sheffield. In addition to private houses, the company supply many steam-engines, breweries, and other manufactories.

The supply of all the necessaries of life is abundant and cheap. Milk is brought into the town in barrels, in carts, and on ponies and asses, by the small Derbyshire farmers around Sheffield.

Two causes, in the first instance, mainly contributed to raise Sheffield into an important town; viz., the possession of vast mineral riches; and water power, by which, before the introduction of steam, grinding was carried on. The first steam-grinding was erected in 1786, when grinding became a separate branch of trade.

“Thus”, writes the classical historian of Hallamshire, “has Nature been bountiful to the parish of Sheffield: not by bestowing upon it the most delicious fruits, double harvests, or

perpetual summer; but the means and materials of durable and substantial comforts, so placed that they may serve as stimulants to labour. And, accordingly, her sons are an active, acute, and hardy race; patient of toil, unwillingly submitting to unnecessary restraints, aware of the advantages of their situation, proud of the reputation they have obtained for her, attached to their birthplace; and, wherever they go, remembering with more than common affection the tall graceful spire that surmounts the town, the woodland heights around it, and the streams which glitter along its devious valleys. Even the very sound of its waters poured over their broken weirs, or the slow moving wheel, the hiss of the grinding stone, and the noise of the forge, are grateful in recollection on the ear of the genuine son of what is fondly called 'old Sheffield'."

In Sheffield, the artisans have generally a house for themselves, and those who live in the suburbs frequently a garden. In times of good trade, at least, it is unusual to find two families under the same roof; and there is hardly an instance of an inhabited cellar in the town. The average number of inmates to each house is rather more than five; and many of these dwellings either front the street or open into moderate sized yards. It cannot fail to have been noticed, in reading what has already been written, that, at certain periods, numerous houses are returned as uninhabited in Sheffield. During a period of active trade, the demand for cottage houses is very great, and speculators are induced to run them up as slightly and rapidly as possible, in the hope of obtaining, for a time at least, an enormous percentage; and hence, when a reaction takes place in the trade of the town, the speculative builders, who have paid but little attention to what are really the legitimate wants of a population, find to their cost that the cottage accommodation that has been created is far beyond what is required.

I have already stated that there is probably less of the confined alley and narrow *cul-de-sac* in Sheffield than in many other manufacturing towns, and that a good deal has been

done of late years to improve the sewers and surface drains of the town; but still much more is required to render perfect the sanitary condition of the inhabitants; and the working classes appear but little aware that all measures for effecting improvements in the drainage of the streets, the supply of water, and ventilation, may be rendered nearly inoperative for the obviating of the causes of disease, if a nidus of morbid effluvia be permitted to remain in almost every part of the confined court where the artisan opens his window in the hope of purifying his small habitation with the breeze of summer, but gets instead a mixture of gases from dunghills, ashpits, etc., or, what is even worse, because more insidious, from a soil which has become impregnated with organic matters imbibed long before, and now, though perhaps to all appearance dry and clean, emitting the poisonous vapour in its most pernicious state.

The importance of a plentiful supply of pure air and water, as well as of selecting a home that can constantly be cheered and lighted by the sunbeams, appears but little understood by many of the artisans of this country; a home in a dark back court being often selected on account of its cheapness. Some medical writers of no little authority have gone so far as to assert that impure air and want of light are the only real causes of scrofula; and, although other adverse influences may doubtless have a tendency to promote the mischief, impure air and want of light are often, at any rate, essential to its establishment. The scrofulous children of the artisans of Sheffield, admitted under my care at the Sheffield Public Dispensary, are most frequently brought from such abodes. In a very sensibly written essay, M. Baudelocque contends that, even if a child be fed on a sufficient quantity of good and nutritious food, if living in a house so placed that the sun's rays do not reach it, or the fresh air cannot be supplied in sufficient quantities, the strumous diathesis will in all probability be induced. "If", says he, "the house be small, dark, low, and badly aired, scrofulous disease will inevitably intervene;" and it is very certain that, in

the houses inhabited by the artisans in the larger manufacturing towns, even when a sufficient supply of food is given, such food cannot properly be assimilated in the absence of light and pure air. What must inevitably be the result of keeping an infant in a close, dark, badly ventilated room? The external lymphatic glands, more especially those of the neck, enlarge; the hue of health will be exchanged for a pallor which gradually creeps over the countenance; the muscles become soft, the abdomen enlarged; and, in a very short time, the tuberculous constitution may be established, and this too in a child whose parents are perfectly healthy, and whose brothers and sisters have never exhibited any symptoms of phthisis. These evils of course exist in degree; and, even supposing a child brought up in such an abode to escape for a time, what must soon or late be the fate of such a one, first reared in a home placed amid the tainted air of some dark narrow back street of a large town like Sheffield, and then, at the age of eight, ten, or twelve, set to labour at the trade of a fork-grinder?

Excessive dissipation, no doubt, has a tendency to diminish the duration of life amongst many of the Sheffield grinders, although I am most happy to bear my willing testimony to the great improvement which of late years has taken place in the habits of these men. The early age at which so many of them commence their calling prevents, in many instances, even the imparting of the rudiments of education. Ignorance, improvidence, intemperance, and crime, are but too often congenial and inseparable companions; and those who have no resources within themselves but too often seek recreation in intoxicating drinks, and in pursuits which are little creditable to the civilisation of the nineteenth century. Still, as I have already stated, the social condition of the grinders has much improved. In my visits to various wheels, it has not been an uncommon circumstance to find the Sunday-school teacher employed in shaping a razor; and some of the most active and intelligent of the Committee of the People's College and the Mechanics' In-

stitution working by their side. The fact is becoming more and more apparent to these men, and it must be made still more so, that the appliances of science can and will lessen the high rate of mortality which at present exists; and that recklessness which only contemplated, in years that are past, "a short life and a merry one", will, I trust, ere long become an exception rather than a rule. My experience as a Director of the Savings Bank in Sheffield also induces me to conclude, from the increased number of depositors, that some of these men are beginning to think more generally of to-morrow, and that habits of economy and prudence are on the increase. It may be added, that many of the grinders are now members of freehold land societies.

There is yet in Sheffield another very lamentable source of dissipation and wretchedness amongst its artisans: I allude to early marriages. How to support a wife never appears for one moment to enter into the calculations of the boys who get married. Many of the grinders select their "partners for life" from girls who, from a very early age, have been employed in warehouses, or from hair-seating weavers and spoon and comb buffers, and who are altogether ignorant of household affairs. What is the inevitable consequence? The wages of the husband are not employed to the best advantage. To *waste*, as a matter of course, succeeds *want*; home is made miserable; and, in the excitement of company at the public house, and in intoxicating drinks, the husband seeks that happiness which he has not at home. The evils produced by these early and thoughtless marriages, I honestly believe, cannot possibly be exaggerated.

In my next communication I shall endeavour to explain the nature of the occupation carried on by a grinder; to describe the wheels in which they work; wet and dry grinding, etc. I shall also show the number of men and boys at present employed; the average age of the men now working in the different branches of the trade; the ages, so far as they can be ascer-

tained from the books at some of the principal wheels, at which, for some years past, the grinders have died; the effects of grinding on the animal economy; and, lastly, the means which appear best calculated to improve the physical and social condition of these artizans.

B. THE SHEFFIELD GRINDERS, AND THE NATURE OF THEIR OCCUPATION.

GRINDERS may be divided into three classes—1. Dry grinders, using only the dry stone; 2. Mixed, or those who partly grind on the dry, and partly on the wet stone; and 3. Wet grinders.

The trade of a grinder is carried on in a building called a *wheel*. In and near Sheffield there are about ninety-six wheels, and of these eighty are steam wheels, and the remaining sixteen water wheels. Each wheel has a number of separate rooms, which vary in size and the number of the stones they contain, in which the grinders work. As a general rule, wet grinding, and the heavier branches of the trade, are carried on down stairs; the lighter branches in the rooms on the upper stories. The heavier branches of grinding are, scythes, saws, table knives, machine knives, edge tools, files, etc. The lighter branches include spring knives (pen and pocket knives), razors, scissors, forks, spindles, needles, etc. Needle grinding is not extensively carried on in Sheffield. Some of our opticians employ a good many hands in grinding glass.

The rooms in which the men work in the different wheels are called *hulls*, the literal meaning of which is a *stye*; and a visit to some of them would convince any of my readers that it would indeed be difficult to select a more appropriate appellation. In each room are placed a number of *trows* (troughs), more or less in proportion to its length. Some rooms will contain as many as ten; some not more than two. The trough, which is made of cast metal, is received into the floor of the room, and contains the water in which the grinding stone revolves. When

the stone is run dry, the water is removed from the trough. Each trough has several divisions, one for the "stone", one for the "glazier" or "lap", and one for the "polisher".

The *glazier* is a wooden wheel, varying in size from four inches to four feet in diameter: it is covered with leather. This is dressed all over with glue and emery; and, when this application has set, the surface is well rubbed with emery cake, which is a compound of suet, beeswax, and emery.

The *lap* is a wooden tool, faced with lead, on which the sides of penknives, the sides of razors, and the flat sides of the better finished scissors, are rubbed, to give them a flat surface. The effect of this will at once be evident to any one who may have a first class Sheffield knife, on comparing the pen with the pocket blade, or a razor with a table knife. The lap is coated with oil and emery.

The *polisher* is placed at the back part of the hull; it is a somewhat smaller wooden wheel than what has already been described, covered with leather, and is made to revolve much more slowly than either the grinding stone or the glazier. If it were made to revolve rapidly, the blades either of the knives or the razors that were undergoing the process of polishing would become heated, and their fine temper destroyed. Although the glazier revolves with considerable rapidity, the paste with which it is coated prevents this effect. A dry powder, called "crocus", which is in fact an oxide of iron, is used for polishing. Boys first begin to learn their trade by polishing the different articles. Boys are apprenticed to the lighter branches at from nine to thirteen years of age, and to the heavier branches of grinding at from twelve to fourteen. Some go to the trade even younger than this. In my recent visits to the wheels, I met with one boy only eleven years old; he had been in the hull since the age of eight: he had a fearful cough, and, on examination, I found the upper portion of both lungs extensively diseased.

In the back part of each room is a drum, or wheel of much

larger dimensions than any of those already noticed, which is set in motion by the steam-engine ; and to it the grinding stones, glaziers, and polishers, are attached by the wheel-bands. The wheel-bands consist of broad leather straps ; and the connexion between the different wheels and the drum can be effected or discontinued in a moment, with the utmost facility, by putting the wheel-bands on or off.

The different kinds of stones used in grinding, and the sizes employed, have already been described.

In manufacturing a razor, both the dry and the wet stone are employed ; and therefore a description of the different processes a razor undergoes will best explain the operations carried on in the hull of a grinding wheel.

The razor is first forged out of a bar of steel. It is then sent to the grinder, who shapes it on the dry stone into the required pattern, whilst it is in the soft state. After the razor has been "shaped", it is returned to the forge, to be "file-cut" and "marked": the mark stamped upon it is very frequently that of some distant firm ; it may be in London, or Glasgow, or any other town. Why our manufacturers allow this, has often been a puzzle to me ; for it most certainly has enabled others at a distance to gain a reputation they would never have obtained but for this procedure. The razor next undergoes the process of hardening and tempering, after which it is once more brought to the wheel, and ground to an edge on a wet stone. It is then "laped" on a tool the exact size of the stone on which it has been ground. The back and the end of the tang is "glazed" ; and the whole of the blade is then wiped quite clean, and afterwards highly polished with crocus. It is next sent to the hafter, who places it in the "scales" (handle), and "sets" (sharpens) the razor ready for use. Serviceable razors can be made at all prices, from one shilling to the elaborately finished and costly articles which were specially manufactured for the Emperor of the French.

The following table will show the immense quantity of steel-

dust that must of necessity be created in the first process a razor undergoes on the dry stone.

TABLE II.—*Shewing the weight of a dozen of razors in the different stages of their manufacture.*

SHAPE OF THE RAZOR: QUILL BACKS.	lbs. oz.	SHAPE OF THE RAZOR: SWAGED BACKS.	lbs. oz.
Twelve razor blades, forged in the rough	2 4	Twelve razor blades, forged in the rough	2 0
Twelve razor blades, shaped	1 15	Twelve razor blades, shaped	1 10
Twelve razor blades, finished	1 10	Twelve razor blades, finished	1 8
Loss in shaping, five ounces per dozen, principally on a dry stone.		Loss in shaping, six ounces per dozen (dry).	
Loss in grinding on the wet stone, five ounces per dozen.		Loss in grinding, two ounces per dozen (wet).	

The above varieties of razors have been selected as patterns generally in use; and the experiments were kindly made for me by Mr. John Wilson, a most intelligent pen-blade grinder in the wheel belonging to the well known and celebrated firm of J. Rodgers and Sons, cutlers to Her Majesty. In some of the very large and heavy kinds of razors—for example, such as those used in the shaving of velvet—a much greater quantity of steel-dust will be made in shaping them. Some little difference will also arise from the way in which the different razor-blades have been forged.

Great friction is required to grind a razor to its proper shape. Razor backs are for the most part round; and the pressure during the process of shaping is so great that no wet stone could sustain the rolling friction; the stone would soon become uneven, like a hammer-stone, and so pulverised that, after shaping four or five blades, the workmen would be unable to hold the blade on the stone. Forks, razors, table-knife-bolsters, scissors, shanks, and needles, undergo the rolling process, and consequently require the dry stone. Spring knives

(pen and pocket knives, etc.), twenty years ago, were ground on the dry stone: the march of improvement, however, has superseded that process; and these blades are all now ground on a small wet stone, which is made to revolve with great rapidity. In shaping razor-blades, etc., on the dry stone, an immense number of red hot particles of steel fly about in all directions; from these "notes", as they are called, the eyes of the grinders were constantly injured, and in some cases permanently lost. The danger is now obviated by wearing large spectacles of ordinary window-glass: the protection they afford is very obvious; for, on examination after they have been a short time in use, the glasses are found spotted all over with the marks made by the particles of heated steel on their surface. In shaping a dozen large razors on a stone seven inches in diameter, the stone would be reduced nearly one inch.

During the process of dry grinding (and in dry grinding the greatest danger to the workmen arises), the dust which is created from the stone and the metal pervades the room in considerable quantities. But it is not only in grinding that dust ascends: much of the evil resulting from the trade of a grinder (and to this dry and wet grinders are alike liable) proceeds from "hanging" and "racing" the stones. The stones are received at the wheels from the quarrymen in a rough state. The grinder then drills a hole through the centre, and, fixing it on the axle, places it in the "trow"; it is then made to revolve slowly, in order that the steel which is used in the process of racing may bite. With this bar of steel, the asperities of the stones are removed, and their surface rendered level and smooth. During the operation, the rooms are unavoidably filled with dust; the dust also arises in perfect clouds when the sides of the trow are swept, after the process of racing is over: it takes about half an hour to race a large stone. The stones are now fitted with plates and screws, instead of with wedges, as was formerly the practice; and the number of accidents from the breaking of a stone are at present much less frequent

than when the old plan was in operation. The saw-grinders at one time were often very seriously injured from the stones breaking whilst they were at work. The large size of the stones, and the weight and length of many of the saws they have to grind, will easily account for this branch of the trade being more dangerous, from the breaking of the stones, than when the articles are smaller and lighter.

Much dust is also created in glazing and polishing: the amount will depend in a great measure on the nature of the glaze used; that employed in the glazing of forks is the most injurious.

It has already been intimated that grinding may be divided into dry, mixed, and wet. Forks, needles, brace-bits, spindles, etc., are ground entirely on the dry stone; and, in addition, table-knife-bolsters, shanks, shaping razors, humping scissors (or giving the rounded form to the blade), etc., etc., all require the dry stone to be employed. Some trades never use the dry stone, as, for example, saws, files, sickles, etc. Table-knives, edge tools, saws, scythes, etc., are only ground and glazed. There is also in Sheffield a numerous class called jobbing grinders, who work on the wet stone, and who are employed in grinding engravers' steel-plates, hammers, fenders, fire-irons, stove-grates, busks for stays, candlestick-bottoms, nippers, garden-shears, hoops, etc.

The following statistics with regard to the present condition of the Sheffield grinders have been collected with no little care and trouble. Formerly, these statistics could be much more readily obtained, because most of the trades were organised; now, many of the unions are broken up. The information has been obtained by personal inspection of many of the wheels, and by employing an old and intelligent grinder to go from wheel to wheel to collect returns from the presidents and secretaries when the trade was organised; and, when this was not the case, from the secretaries of the different wheels, and from the men employed in them. These returns I have afterwards read over

to several of the most intelligent grinders in each branch, and they one and all agreed that they were as accurate as it was possible to obtain. They may, I am certain, therefore, be taken as a close approximation to the truth.

Fork Grinders. The men employed in grinding forks work on a dry stone. It is by far the most destructive of the grinding trades carried on in Sheffield. One hundred and sixty men, and one hundred and twenty boys, are at present engaged in it. Excluding the boys, or all under twenty-one years of age, the average age of the hundred and sixty men only amounts to twenty-nine. Some notion of the known fatal nature of fork-grinding may be gathered from recording the observation made to me by a fork-grinder in one of the wheels: "I shall be thirty-six years old next month; and you know, measter, that's getting a very old man in our trade." Individual instances of men living longer than this, no doubt, can be found at present in Sheffield amongst fork-grinders; but it is an undoubted fact that a great many of these men are cut off before the age of thirty; and that, if commencing, as most of them do, the trade at ten years of age, at the age of twenty-one, if constantly at work, the expectation of life would not most certainly exceed fourteen years. The calculation of Dr. William Farr, in the sixth Report of the Registrar-General, of the probable duration of human life in England at the age of twenty-one, is thirty-nine years; so these unfortunate men, we may conclude, are exposed to influences which have a tendency to rob them of twenty-five years of their lives, to deprive to that extent their wives and families of the benefits of their labour, and to fill the union houses with their widows and orphans. No more graphic picture can possibly be drawn of the effects of this trade than in the address presented some years ago by the fork-grinders to the public; they said: "It is part of our duty to allude to the destructive influence of our trade; for be it known that, in respect to the pernicious effect of grinding trades upon health, our branch is by far the worst. We can

show by irresistible facts, drawn from the statistics of our trade, that the average age of fork-grinders does not exceed thirty years. Nor is this to be wondered at, considering the poisonous atmosphere we have to breathe, which renders the far greater part of us mere shadows of men, and produces a complication of diseases, of which the most formidable is the asthma and dry cough, known by the name of the 'grinders' complaint', attended as it is by consumption, which no medical man can cure. In such cases, life is a burden to the poor sufferers, and their frames are gradually emaciated and wasted by a repetition of slow tortures."

This is unfortunately an "o'er true tale"; nor will I by a word direct attention from a picture which has been so faithfully drawn, except to remark, that poverty often obliges these men to labour when they are altogether unfitted for their calling, and causes them to go to the hull a day or two in each week for a few hours, to inhale additional dust, and thus to increase the disease that is rapidly destroying them, in order to obtain bread.

Razor Grinders. There are now engaged in razor-grinding three hundred men and two hundred and twenty boys. The average age of these men does not exceed thirty-one. This, as before stated, is one of the mixed varieties of the trade, and one of the most destructive.

Spring Knife Grinders. Pen and pocket knives are now ground entirely on a wet stone; about six hundred and eighty-five men and six hundred boys are at present engaged in it. The mortality in this branch has very much diminished since the grinding has been carried on with the wet stone only.

Scissor Grinders. These men work partly on a wet and partly on a dry stone. The most destructive part of the work of a scissor-grinder is when giving the rounded form to the blade, which is called "humping". There are at present three hundred men and two hundred boys employed in grinding

scissors. Hundreds of these men perish before reaching the age of forty. The average age of the men now at work is thirty-two.

File Grinders only use the wet stone. About one hundred and sixty men and eighty-five boys are at present employed. The mortality is much less in this branch than in some of those already mentioned.

Saw Grinders employ the wet stone. One hundred and sixty men and fifty boys are engaged in grinding saws. The average age of the men at present is about thirty-eight.

Scythe Grinders. Scythes are not very extensively ground in Sheffield. Both scythes and sickles are ground at and near Hackenthorpe, a few miles from Sheffield. As a general rule, country grinders are more healthy, and live longer, than those who reside in the town; and I have reason to believe that some of the scythe-grinders employ a portion of the year in making, so that they are not at all times in the wheel. There are about sixty persons (men and boys) employed in grinding scythes.

Wool Shears and *Edge Tools* are classed together by the trade. Of the different branches of wet grinding, that of wool-shears, from the peculiar kind of soft stone used, is the most pernicious. The average age of the men working at it, now living, does not exceed thirty-two.

The following table shows the number of grinders at present employed in the different branches of the trade, and the average ages of all the men now living, those under twenty one being excluded.

TABLE III.

Number of grinders, 1857.	Men.	Boys.	Average age of all the men now living.
1. Forks.....	160	120	29
2. Spring knives	685	600	34
3. Razors	300	220	31
4. Scissors.....	300	200	32
5. Table knives.....	800	250	35
6. Edge-tools and wool-shears	200	80	32
7. Saws	160	50	38
8. Surgeons' instruments	15	12	—
9. Files	160	85	35
10. Sickles	50	20	40
11. Jobbing grinders	280	210	—
Total....	3110	1847	

Total men	3110
Total boys.....	1847
add { Scythe grinders (men and boys)	60
about { Needle grinders	12
<hr/>	
Number of grinders in and near Sheffield	5029
<hr/>	

On getting the returns just given in the above table from the different trades, I resolved to test their correctness, as to the average age of those at present employed, by going to two of the largest wheels in Sheffield, and personally taking down the ages of all the men employed in each hull. The wheels I selected were the Soho and the Union. The Soho wheel has fifty hulls, and, on an average, five hundred men and boys work at it. The Union wheel contains forty-six hulls, and from three hundred to four hundred men and boys are employed. I found the average age of all the razor grinders to be 31; and, in the men I examined, I found one aged 55, one aged 49, one aged 46, one aged 42, one aged 40, and one aged 39. I found the average age of all the scissors grinders to be 32 years and 4 months. In this number were two aged 60, one aged 55, one

aged 54, and one aged 49. When men are found working at razor and scissor grinding at these ages, it often happens that they have been away from the trade some years, or have not worked regularly at it, or that they have taken unusual care of themselves, and have always employed of late years a *fan*. But, even taking the men at these ages, the average of all the men employed was little more than 32. The average age of the spring knife grinders was 34, and of the table knife grinders 35. The average age of the fork grinders at these wheels was only 28. At the Soho wheel, a fine young man, a fork grinder, aged 26, remarked, "that he reckoned, in about two more years, at his trade, he might begin to think of dropping off the perch;" adding, "A fork grinder is an old cock at 30." The average age of all the grinders in the different branches at work at the Union Wheel was 34, and all boys under 21 are excluded from my calculations.

My attention has been directed to the ages at which the grinders have died at the different wheels for some years past, so far as I could collect them. At the wheel of Messrs. J. Rodgers and Sons, which is a peculiar wheel in many respects, being very well constructed, the fan is in general use where the dry stone is employed. The men also are, as a rule, at work on the higher class of goods, and are not obliged to labour so hard as the men who work at the inferior branches of the trade. At this wheel, since the year 1836, the average age at which the grinders have died has been 42. This return, however, only includes razor grinders and spring knife grinders. The oldest was 57, the youngest 25. Two died at the age of 28. The Union and Soho wheels are both first class wheels, and the mortality at them may be considered below rather than above the usual mortality.

The average ages of the grinders at death, at some of the principal wheels, are given in the next table; and the great majority of the grinders (probably eight out of ten) work at about ten large wheels; the rest at small wheels.

TABLE IV.—Average age at death of grinders at the following wheels.

Name of wheel.	Return of deaths since the year	Average age at death.
Messrs. J. Rodgers and Sons	1836	42
Union Wheel	1850	40
Soho Wheel	1845	40
Old Park Wheel	1844	41
Suffolk Works	1845	38½

In the deaths at the Union wheel, there is a return of the death of a grinder aged 70, who had not worked at his trade for some years. Excluding this man, the average age at death would of course be much less. In the deaths at the Soho wheel, I find returned a fork grinder aged 48. This man had not worked regularly at his trade; he had been the chapel keeper at one of the dissenting places of worship in Sheffield many years, and had not been much at the wheel. There is also the return of a fender grinder (wet) aged 64; he came from the country, and had not worked very hard at his trade. Excluding this man from the list of deaths at this wheel, the average age at death since 1845 has only been 38. At the Suffolk Works wheel, which is a well constructed one, and the property of Messrs. Turner and Co., the ages at death since 1845 have only averaged 38 years and 6 months: the ages at death were 25, 46, 47, 49, 27, 61, 35, 41, 27, 23, 48, 50, 41, 22, and 35 years. The man who died at the age of 61 was a table blade grinder (wet); he had worked at a water wheel in the country many years of his life, and had only been a very short time at the Suffolk Works wheel.

In taking into consideration the ages at which these men have died, it must be borne in mind that some of them have probably perished from other diseases, as well as from the one to which grinders are so liable. Still, on looking at these returns, at the low average age of the men at the time of death,

in all these large wheels, the low average age of the men now working in some branches, fork grinders only 29, razor grinders only 31, scissor grinders only 32, as well as the large proportion of boys at work in many of the trades, the high rate of mortality appertaining to the calling of a grinder is certainly perfectly appalling! We observe, also, that the mortality varies with the nature of the trade; and that it is much more destructive of life in the dry branches than in the wet.

Men who work in the country are, as a rule, more healthy than those who grind at the wheels in the town. One of the most healthy branches is that of saw grinding. A number of saws are, it is true, ground in Sheffield, but many of the men work at the water wheels on the picturesque streams around our large manufacturing town; want of water often obliges them to discontinue their work; and as a general rule they have not to labour so many hours a day, as in many other branches. The trade is too heavy to admit of boys coming into it at a very early age, and as the man stands to his work, the lungs are not compressed as when, sitting on his horsing, with his elbows resting on his knees, and his face bent forwards, the grinder is employed on forks, razors, scissors, and pen-blades.

There is another feature, also, of some importance to be considered. Some branches, for example, pen and pocket-blade grinders, now employ the wet stone, who once worked at dry grinding; and, therefore, though at present not exposed to its injurious effects, they formerly were so, and many of them are suffering, more or less. When these men have passed away, and our observations are applied only to men who have worked all their lives on the wet stone, I anticipate that, in this branch, the average age of those employed will be much increased, and the mortality much diminished.

Without anticipating the remarks which belong to the third division of our subject, where I intend to enter into the pathology of the grinders' disease, and to give some drawings of the exact appearances presented by the lungs of several of those

who have perished from it, I may say that, in dry grinding, very often before the age of twenty evidence is afforded of the existence of grinders' disease. The breathing is difficult, particularly when ascending a hill, or the steps leading to the hulls in which they work, and the shoulders even at this early age are often elevated in order to relieve the distress occasioned by shortness of breath.

The cause of this disease is, first, the irritation produced by the metallic and gritty particles inhaled in grinding, in "hanging", and in "racing" the grinding stone; and, next, the constrained position in which the men labour. To this must be added the working for many hours in a badly ventilated room, and the very unpleasant smell produced by the friction of the steel on the grinding stone. When at work, the grinder sits astride of what he calls his "horsing"; this is a low, narrow wooden bench; his elbows rest upon his knees, and his head, particularly when employed on very small articles, is bent over the stone. The position is a very injurious one, and when long continued, is calculated most unquestionably to induce pulmonary congestion.

Again: in many of the heavy branches, such, for example, as table-knife grinding, the men work in the coldest weather without either coat or waistcoat, with their handkerchiefs off, their shirts open, and their chests fully exposed; and this too, in a room every bit of the glass from the windows of which has been removed, that the light may not be obstructed by the splashing of the water rendered dirty by the grinding stone. The work is very laborious, the men perspire freely, and in this condition they will often leave the hull without putting their clothes on, and recklessly lounge about in the yard even in weather as bitterly cold as we have had it this winter. Inflammation of the lungs, pleurisy, rheumatic fever, and diseases of the heart, are consequently not unfrequent amongst them.

The workmen in other of the Sheffield trades suffer from inhaling dust as well as the grinders. Bone scale cutters, ivory

cutters, and the girls employed in the hair-seating manufactures, especially when working with foreign hair, suffer more or less from the dust. A most singular affection is produced on the men who haft knives with cocoa wood and ebony; the dust from both of which woods causes in some instances constriction of the chest, running from the eyes and nose, and symptoms which resemble those present in hay asthma. It also produces, when the skin is at all tender, a peculiar kind of erythema on the hands, face, and other parts of the body.

Prevention of the Grinders' Disease. Can nothing be done to prevent, or at any rate to render less fatal, the occupation of a grinder? This is a question of national importance, and one well deserving our most serious attention. Formerly this disease was unknown, and for this reason; until the year 1786, when the first steam wheel was erected, grinding was not carried on as a distinct branch of trade. The grinding wheels were all built upon the banks of the rivers in the district around Sheffield, and water being the power employed to turn them, it will at once be obvious that the grinder would have many interruptions to his trade, and that to labour day by day as many hours as the grinders do at present, was altogether impossible. Nor was this all; by the old regulations of the Cutlers' Company, passed in the reign of Elizabeth, it was provided that "No person engaged in the said manufactures, either as a master, servant, or apprentice, shall perform any work appertaining to the said science or mystery of cutlers for eight and twenty days next ensuing the eighth day of August in each year; nor from Christmas to the twenty-third day of January, upon pain and forfeiture for every offence, found and presented by twelve men of the said fellowship, of the sum of twenty shillings. No person occupying any wheel for the grinding of knives to allow of any work being done during the holiday months: penalty as before."

When grinding became a separate branch of the Sheffield manufactures,—when the hours were no longer limited during

which the men were employed, and when the fearful effects on the animal economy of the particles of steel and grit became apparent, attempts were made to remedy the evil.

The first plan suggested was that of a wooden flue, extending from the grinding-stone to the chimney, for the purpose of carrying off the dust; this, however, was only partially useful. The next was the invention of Mr. Abraham; it consisted of a magnet used as a mouthpiece, or, as the grinders term it, a "magnetic moustache"; it has fallen into general disuse. The next, and the best, was the fan on the principle of a winnowing machine; and with a flue properly constructed, leading from each of the different wheels in each hull, the dust may be most effectually driven out of it, and the pernicious effects, both of the particles of grit and metal which arise in grinding, and of the dust created in glazing and polishing, in a great measure prevented. In two hulls, one at the Union wheel, and one at the Soho wheel, and also in the hulls at the wheel of the firm of J. Rodgers and Sons, I saw the fan at work with the happiest effects. In the hull of G. Trickett, at the Union Wheel, the different operations were gone through in my presence without making any dust; and at the Soho wheel I saw that shaping razors and racing a stone, by adding a properly contrived box, could be rendered perfectly innocuous by the use of the fan; all the dust being driven off by the fan up the shaft on the outside of the building. The particles of dust and steel not carried away by the fan in racing a stone may be prevented from entering the air-passages by a very simple contrivance, consisting of a piece of wadding sufficiently large to cover the mouth and nose, enclosed between two pieces of silk, and secured by a band of elastic to the back of the head.

That the fans, or, as the grinders call them, "*fannies*," answer perfectly, I have convinced myself by actual experiment; and I have also received the unqualified testimony of

all the most intelligent dry grinders who use them of the advantage to be derived from them. A razor grinder at the Suffolk Works wheel assured me that but for the fan he should not have now been living; and he said, "If I were to shape twelve razors without a fannie I could hardly breathe next day; with a fannie I can shape them and feel as well as ever I did in my life."

To those who are not as conversant with the economy of a grinding wheel as myself, the question naturally suggests itself, how comes it, that with a contrivance so admirable and so effectual for carrying off the dust from the steel and grinding stone, the mortality is so great? I am sorry to say that these fans are far from being in general use. In some wheels I did not find one; and I went into hull after hull in other wheels where the men were humping scissors, shaping razors, and grinding forks—the most destructive kinds of grinding, as we have seen—without finding one at work. In other hulls one man perhaps was at work with a fan, and the next was destroying himself and his fellow-workmen by grinding without it; in another the man at the end *throw* had put up a fan that would serve the whole hull, which he charged, perhaps, each man a penny a week for; the man next him paid for the fan, but not having been at the trouble to fix a box, it was useless to him. Others had the fan fixed, but not at work; "the noise was too great for them." And (I blush to write it, but such was the case) some dry grinders told me, that "the trade was bad enough as it was; and if the men lived longer it would be so *over full* there would be no such thing as getting a living." To such men I would say,—if ever there was a trade more poisonous than the fabled valley of the Upas—more slow in its effects, it is true, but equally deadly with the inhaling of the atmosphere of the famous Grotto del Cane—it is that of a fork-grinder who works without employing the effectual means for his preservation which the fan affords. And, over the door

of the hull of every fork-grinder who day after day ventures to grind without the fan, ought to be written,

“ All hope abandon, ye who labour here ” ;

for the work in which you are engaged, without this protector, will most certainly destroy you. The cost of a good fan is from 30s. to £3.

Allusion has already been made to the age at which boys are taken to work at the wheel. To send a boy at eight or ten years of age to work at polishing forks, in a grinding hull, is an act of refined cruelty which the powerful arm of the law can alone restrain. The application of the Factory Act to the Sheffield grinding trades would, in my opinion, be most wise and salutary. These helpless children I would indeed commend to the protection of the state; and glad indeed shall I be if these remarks attract the eye of any member of the House of Commons and induce him to bring the question before parliament; or if the evils, moral and physical, under which these poor boys are suffering, lead the inhabitants of Sheffield to petition the legislature to throw around them that protection which they have not at present. The early age at which these boys are made to work, and the many hours during which, day by day, they labour, render it impossible to give that general instruction, and religious training, which we have a right to see extended to all classes in a Christian land. The immense competition that exists in many branches, the manufacture of articles to supply the “ Cheap Johns ” and others who frequent our markets and fairs—articles which are made for *sale* and not for *use*—has doubtless caused many more boys to be employed than would otherwise have been the case; the men remarking, with some degree of justice, that inferior goods are charged so low that they are obliged to make boys work with them or they could not get a living.

The present high rate of mortality amongst the grinders in Sheffield, I am certain, may be diminished by—

1. Reducing the hours of labour.
2. Preventing boys from being apprenticed to the trade so young as at present.
3. Obliging all dry grinders to use a fan, and to keep it in active operation.
4. Preventing dry and wet grinders from working together in the same hull.

I. *Reducing the hours of labour.* It is a notion in Sheffield that a drunken grinder often lives the longest. This a very great mistake; for intemperance has hurried hundreds of these men to the grave. I have almost invariably remarked that so soon as the liver becomes affected, the chest symptoms are much increased; and that when the liver fails to discharge its functions a very slight amount of disease in the lungs of a grinder will cause far more distress and difficulty of breathing than much more extensive disease when this organ acts properly. The truth is, that the drunken grinder is much away from the wheel: he does not work so many hours at his trade as a steady man, and thus escapes the evils which arise from the dust, and the injury to his lungs which a long continuance of labour, day after day, in a constrained position must occasion. By limiting the hours of labour, time would be afforded for indulging in out-of-doors pursuits—in exercises which would bring the different muscles of the body into play, and have a tendency to prevent some of the effects resulting from bending over the wheel when at work. It must not be forgotten, that until grinding became a separate branch of trade, and steam-power enabled the labour to be constant, the disease which forms the subject of our present inquiries was hardly known.

II. *The prevention of children entering the wheel at an early age* would afford an opportunity for the body to develop itself on the one hand, and that needful education to be given on the

other, which would remove the fearful ignorance at present existing, direct the mind to pursuits which are ennobling, and give to the Sheffield grinders, as a body, a position in the social scale to which they have never yet attained. With the removal of the present state of ignorance, the importance of those general hygienic principles so conducive to health and to longevity would be more generally adopted, and the wheel well ventilated, kept clean, and frequently white washed, and no longer regarded as a place "only to work in," and of no importance whether clean or dirty. At home efficient reforms could not fail to be effected; during the day every room in the house would have air freely admitted, and the sleeping apartment, no longer overcrowded, would be ventilated either by taking out a brick over the fireplace near the ceiling and placing a bit of silk over the hole to keep out the soot, or by substituting ribs of glass for one of the upper panes in the window. Personal cleanliness would not as now be neglected; for the occasional use of the bath, sponging with cold water daily, friction with a coarse cloth or a flesh brush afterwards, should never be omitted by these artisans. And, when the minds of these industrious workmen shall awaken to the importance of employing the three great sanitary agents, Light, Air, and Water,—agents which are all important for the preservation of health and the prevention of disease; when the folly of intemperance is admitted, improvident marriages avoided, and boys are allowed to remain at school instead of being forced at eight and ten years of age into the hull of the grinding wheel, then, and not till then, may we hope to see the high rate of mortality which at present exists diminished, and with a reasonable hope of lengthened days, the Sheffield grinders discharging faithfully the duties of that station of life unto which it has pleased their Creator to call them.

The pathology and treatment of The Sheffield Grinders' Disease will form the subject of the next section.

C. THE SHEFFIELD GRINDERS' DISEASE.

There is no necessary connexion between the Sheffield grinders' disease and thoracic consumption, although both affections may be present in the same individual, as in the cases described by Sir Arnold Knight, in the *North of England Medical and Surgical Journal*, vol. i, p. 86.

Many years ago, Mr. Thackrah pointed out the effects of arts, trades, and professions, on life and longevity. Stonemasons, quarry-men, cotton-batters, miners, leather-dressers, needle-pointers, machine-filers, and, in Sheffield, the grinders, all suffer more or less from inhaling, during their labours, an atmosphere which is loaded with irritating particles.

In Sheffield, the fork-grinders suffer the most severely, being what are termed dry grinders. The mortality ranges next in degree amongst razor grinders and scissor grinders, and those who work partly on dry and partly on wet stones; and the statistics I have collected, go to shew that it is much less amongst the men who work altogether on a wet stone. It should, also, be added, that the mortality is greater amongst the workmen who are obliged to labour in the town than amongst those carrying on the same trades in the villages around Sheffield. In all these cases of chronic bronchial disease, there is, in addition to the question of pulmonary irritation, the fact that many of these men are exposed to influences tending to induce the tuberculous cachexia. They pass many hours every day in a confined and deteriorated atmosphere; and the position in which they are obliged to work is unfavourable to the free action of the respiratory organs; and many of them are very intemperate. Much of the evil arising from the inhalation of metallic and gritty particles, I have already shewn could be avoided by working in hulls, where fans are provided to prevent the inhalation of grit, dust, and steel; but, singular to relate, these men are so indifferent as frequently not to make use of the means at their disposal for

rendering their calling at any rate less injurious. Dr. Alison has stated that "there is hardly an instance of a stone-mason in Edinburgh free from an affection of the lungs at the age of 50" (*Trans. Med. Chir. Soc. of Edinburgh*, vol. i); and Dr. Forbes, "that an immense proportion of the miners in Cornwall are destroyed by chronic bronchitis." (*Trans. Provincial Med. and Surg. Association*, vol. ii.)

A chronic affection of the lungs is very common amongst bricklayers, and the poor Irish generally in the metropolis and the larger manufacturing towns. Exposed to every inclemency of the weather, scantily clothed and badly fed, one attack of catarrh, bronchitis, pleurisy, or inflammation of the lungs, is quickly succeeded by another, until at length the whole of the lungs, having their pleura more or less adherent over their whole extent, present a mass of disease, partly tuberculous, and partly the result of chronic inflammation. Some difference of opinion has been expressed as to the real nature of the apparent tuberculous infiltration, from the resemblance it bears to chronic pneumonic consolidation. Dr. Walshe regards them as identical. It is possible, however, that, in a person whose blood is affected to a great degree with the tuberculous dyscrasia, inflammatory hyperæmia may lead to the exudation of a material having a close resemblance to the tuberculous, but not so inclined to soften and break down.

Wepfer (*Observ. de Capitis Affect.*) had observed, even in his day, the destruction of the miners employed in cutting mill-stones from the mines of Waldschut, on the Rhine, where all the men are said to have become consumptive. The pernicious effects of the inhalation of silex, in a minute state of division, is related by Benoiston de Chateaufort and M. Clozier (*Le Blanc, Œuvres Chirurgicales*, vol. i, p. 585); and, many years ago, Dr. Johnson, of Worcester, described (*Memoirs of the Medical Society of London*) the injurious effects to the respiratory organs from the inhalation of metallic particles, as exemplified in needle-grinding.

(a) The *symptoms* of the Sheffield grinders' disease during life, (b) the *post mortem* appearances presented by the lungs of those who have died from it, and (c) its *treatment*, invite our attention. The means of prevention were considered in the last section.

(a) *The symptoms of the Sheffield grinders' disease during life.* The symptoms vary, of course, in each individual case, the length of time the disease has existed, and the extent of lung involved. After working some years at dry grinding, without the protection of the fan, the disease creeps by slow degrees upon them, and often, before the age of twenty-one, has made some progress; the digestive functions become impaired; the breathing is short and difficult, even after very slight exertion; the face has a dirty white aspect; the countenance is indicative of distress; and they complain of a sense of constriction across the chest, and a dry sensation at the back of the throat. To these symptoms succeeds a cough, at first dry; after a time, this cough is attended by expectoration; the sputa is at first frothy, and indicative of irritation. Sometimes the expectoration contains a little dark coloured matter, which, in a large manufacturing town like Sheffield, is thought by many to owe its origin entirely to the carbonaceous matter floating in the atmosphere; but, on the addition of nitric acid, the colour fades, and we must, therefore, conclude that some of this dark colour is derived from the pigment-cells, where I know it to increase even under very slight attacks of bronchial irritation. Figs. 1 and 2 present the appearances observed on looking at the sputa of the wet and dry grinders with the microscope. The objects in each circle are magnified 250 diameters.

The sputum at the bottom of the circle, *a* and *c*, was from a file-grinder. The admirable drawings whence this wood-cut by Mr. Orrin Smith has been taken, were made for me by Mr. Tuffen West, from two slides that I prepared for him. The other objects were from a table-blade grinder, who, having suffered for some months from grinders' disease, gave up his employment; at this

time, the disease may be said to have been arrested. The sarcina was discovered in the expectoration of this man; it was coughed up in my presence, and at once put up in a glass cell, and forwarded to Mr. Tuffen West. I discovered sarcina several times in the sputa of this man—the only instance in which I have seen it in the expectoration; and, so far as I know, until it was figured in my recent work on consumption (*"Hints on the Pathology, Diagnosis, Prevention, and Treatment of Thoracic Consumption"*, by J. C. Hall, M.D., with twelve microscopic illustrations), no one had mentioned the discovery of it in the expectoration.

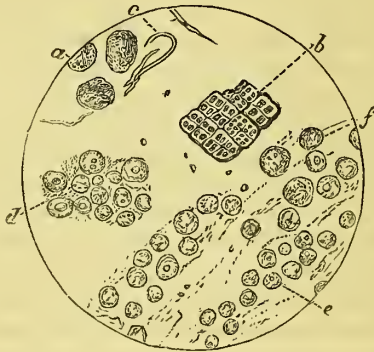


Fig. 1 contains the sputa of a table blade and file grinder. (a) cells containing pigment; (b) sarcina ventriculi; (c) curled elastic fibre; (d, e, f) pus and mucus cells; some very transparent, shewing a distinct nucleus; others (f) with pigment.

The sarcina ventriculi was discovered by Professor Goodsir, in 1842, in some matters vomited by a patient. It has been found in the urine by Haller, Dr. Mackay, Dr. Johnson, and Dr. Lionel Beale; in the fæces, by Dr. Bennett and Dr. Hasse; by Dr. Jenner, in the fluid of the ventricles of the brain; and by Virchow, in an abscess of the lung. M. Robin has arranged

it under the genus *merismopædia*, and has given to it the name of *merismopædia ventriculi*.

As already stated, the other objects in the circle are from the sputa of a file-grinder.



Fig. 2. Sputa of a fork grinder (dry). (a) epithellum from the mouth ; (b) epithellum from the fauces ; (c) silicious particles ; (d) metallic particles ; (e) blood-corpuscles ; (f) pus and mucus cells.

It should be added, that the expectoration from which this drawing was made was coughed up soon after leaving the wheel at which the man had been at work. The quantity of the particles of steel and stone observed in the expectoration is of course much greater in a grinder who has just come from a wheel where he has been working without the fan.

Sometimes, as the disease advances, and a cavity is formed in the pulmonary tissue, the softened and broken up matters find their way into the larger bronchi, and the sputum, when placed under the microscope, is found to consist of pus, mucus, melanotic, oily, and granular matter, interspersed with epithelium, and the curled elastic tissue surrounding the pulmonary vesicles. It is at the period of the formation of these excavations in the lung, that I have most frequently observed in the sputum, the elastic tissue forming the areolæ of the air-vesicles.

If asked to present a brief *résumé* of the physical signs of the Sheffield grinders' disease, I would say, those of bronchitis and dilated bronchi in some cases; in others, of emphysema, or of consolidation; and, lastly, of excavation: but, in many cases, the general symptoms are not in proportion to the extent of the disease in the lungs. In Sheffield, a knowledge of the occupation of the patient must always, however, ensure, with ordinary care, a correct diagnosis.

There has been for many years past no little difficulty in investigating this disease in Sheffield, from the great repugnance of this class of men and their friends to permit a *post mortem* examination; and, although this foolish prejudice is not so great as formerly, there is still frequent objection made to the examination of the body after death. Accounts of *post mortem* examinations have been published by Mr. Gregory, Mr. Porter, Mr. Gillott, and by the late Dr. Charles Fox Favell, whose premature death deprived Sheffield of an accomplished physician, and the profession of the completion of investigations with respect to the grinders' disease that could not have failed to be as interesting as important.

The symptoms present in those labouring under the Sheffield grinders' disease will perhaps best be exhibited by transcribing an abstract of the notes of a few out of the scores of cases that are, and have been, under my care in private practice and at the Sheffield Public Dispensary.

CASES OF THE SHEFFIELD GRINDERS' DISEASE.

CASE I. Adriel Shaw, pen and pocket blade grinder, was admitted under my care at the Sheffield Public Dispensary, February 26th, 1857. He complains of great difficulty of breathing, cough and expectoration. He has always ground on the wet stone, but states that "razor grinders have worked in the same hull with him", and added, "*there is no fannie in my room, nor about our wheel*"; he went to the trade at the

age of fourteen; before that he worked as a cabinet-maker. He came from the country to Sheffield. His father is a gardener; he is living, aged 40; his mother died of thoracic consumption. He had slight hæmoptysis three years ago, but took no notice of it; it has frequently recurred, and he is always attacked with it after "racing" a stone. He began to feel very short of breath six months ago: he now feels very weak, and can take hardly any exercise. He is thin; the chest measures thirty inches, and expands only to thirty and a quarter inches; there is considerable dulness under each clavicle; a loud blowing sound is heard under the right nipple, and a peculiar creaking sound under the left. The expectoration, under the microscope, exhibited pus and mucus-cells, enveloped blood-corpuscles, cells containing pigment, and particles of grit dust.

CASE II. John Gosney, aged 31, scissor-grinder (dry), was admitted March 12th, 1857. He first went into the wheel when nine years old. He has had attacks of shortness of breath, at intervals, for years, but got on very fairly till about a year ago, when he was seized with profuse hæmoptysis, and he has never been well since. He complains of cough, great shortness of breath, and states that he feels "as if a wire had been drawn round his chest." The chest measures thirty-three inches, and does not reach thirty-three and a half inches when he attempts to take a deep inspiration. The chest is generally flat; there is considerable depression under each clavicle; beneath the right clavicle the respiratory murmur cannot be heard; on the left side a few moist clicks may be heard very distinctly about two inches below the clavicle. The sputa under the microscope appeared to be pus and mucus cells; one or two bits of bronchial columnar epithelium could be seen, and several pieces of the elastic tissue forming the areolæ of the air-vesicles were distinctly visible; also some particles of grit and steel.

CASE III. John Stephenson, aged 44, file-grinder (wet), admitted March 12th, 1857. He began to grind at the age of

fourteen, and was never ill till he was thirty: he then began to have a dry cough, and to feel short of breath and fatigued after very slight exertion. He has lost weight. He has several times had hæmoptysis. The chest is flat, and the right side does not rise so well on taking a deep inspiration as the left. The expiratory murmur is prolonged on both sides; percussion elicits on both sides a dull sound immediately under the clavicle, and over a square of about two inches on the right side the respiration is jerking: above and below the nipple, on the left side, a blowing sound can be heard. Posteriorly the respiration in both lungs is feeble. The expectoration is considerable; under the microscope I found that it consisted of pus and mucus; some shrivelled cells with irregular edges, groups of cells with pigment, coming, in all probability, from the bronchial glands; blood corpuscles surrounded with a delicate envelope, silicious and metallic particles, etc. With the exception of the little bits of stone and steel dust, there was nothing to distinguish the expectoration in this case from what is observed in the flocculent sputa of an ordinary case of phthisis.

CASE IV. Henry Longdon, aged 53, razor-grinder (dry), admitted December 29th, 1856; has worked at Marsden's wheel: has used a fan part of his time; worked hard when he was able, but has laboured under grinders' disease many years; he is about 5 feet 4 inches; countenance very sallow; hair iron grey; he stoops a good deal; he complains of the greatest possible difficulty in breathing; has had a cough a great many years, and suffered two or three times from hæmoptysis. The chest measures thirty-two inches, and expands to thirty-two and three quarter inches; the mobility is greater on the right than on the left side; there is considerable dulness on both sides of the chest, more particularly on the left, and the surface is a good deal depressed; the movements of the chest, more especially the costal ones, are impaired; the antero-posterior diameter, and the superficial width of the side, are diminished;

and there is marked parietal resistance. The percussion sound in some parts is tubular, and the respiration weak, and unequal in quality—harsh and bronchial; in two or three places a diffused blowing sound can be heard. The cough was constant; there was not much expectoration at this time; there was thirst and anorexia: the night perspirations were insignificant, but the loss of flesh was considerable. He was seen by me at intervals, till he died on the 4th of March, 1857. No *post mortem* examination was allowed, as is too often the case in grinders.

CASE V. Henry Wollen, aged 28, pen-blade grinder (wet), was admitted June 29th, 1854. He complains of shortness of breath, cough, night-sweats, and loss of flesh. He has frequently had hæmoptysis. There is depression of the infraclavicular region on the left side, and the respiration on both sides is rough and jerking; the jerking respiration, I should add, was *partial*, and confined to the upper portion of the right lung. The expiratory murmur was prolonged.

CASE VI. Frederick Clark, aged 19, a razor grinder (dry), was admitted September 18th, 1854. The disease had made considerable progress; he had been in the wheel from an early age. He has had cough and great difficulty of breathing for several years: he states that “he has occasionally spit blood;” his dyspnoea is aggravated on the slightest exertion; there is œdema of the feet and ankles; the clavicles are prominent, and there is a deep hollow between them and the upper ribs; the respiration is feeble on the left side, and a series of clicking crepitations may be heard during both the respiratory movements: there is a cavity of considerable size at the upper part of the right lung. He died on the first of November. No *post mortem* examination was permitted.

CASE VII. James Hodgkinson, aged 21, a table-blade grinder (for the most part wet), consulted me, April 4th, 1857. He has a pale pasty-looking face; he stands 5 feet 3½ inches, and weighs 8 stone 7 lbs. His mother is living, aged 55; his father,

a table-blade grinder, died of the grinders' disease at 39, and his grandfathers, on both sides, died of the grinders' complaint. "Does not think consumption was ever in his family." He went to the wheel at the age of thirteen, and has been in it ever since. He has felt a dryness in his throat for a long time, and has been "a bit out of wind when going up hill, but nothing to mean anything;" he has got worse the last few weeks, and "the dry cough begins to trouble him very much." He works mostly wet; the bolsters of the table-knives are ground dry. "He suffers very much from dust when they 'race' the stones, which fills the hull with dust." He has never spit blood. His chest measures thirty-four inches, expands to thirty-five inches; fairly formed; movements better on the left than on the right side: slight dulness under each clavicle; the respiration is harsh; the expiratory murmur is prolonged on the right side; and, three inches under the clavicle, a slight blowing sound can be heard.

I give this case as illustrative of the earliest symptoms of the Sheffield grinders' disease. By abstaining from work a few weeks, under appropriate treatment, this man will recover; at any rate, for a time.

CASE VIII. Ellen Kennedy, aged 21, admitted November the 6th, 1856. This girl is employed in a hair-seating manufactory; she has been engaged in working foreign hair; there is much dust in the room in which she works, and the hair has a very unpleasant smell. She has had a dry troublesome cough for some months, with considerable difficulty of breathing; she is much thinner. The pulse is 86 when sitting, and 96 when standing. The chest is well formed; the body tolerably well nourished. There is slight dulness under each clavicle; the respiratory murmurs are harsh, and especially on the right side of that diffused blowing type, to which reference has already been made. Both her parents are dead: the mother died of phthisis. She was advised to discontinue her employment; the croton oil liniment was applied to her chest,

and some expectorant medicine administered, with a few grains of the compound ipecacuanha pill each night. She was ordered a milk diet, and after a week or two, meat once a day and a glass of bitter beer. The counter irritation was kept up at intervals for about three months, and she took, during the same period, cod liver oil. Under this treatment the cough left her, she gained flesh, and, when she was discharged, expressed herself as quite well.

The above have been selected from my notes of a great number of cases that have been entered in the books of the Sheffield Public Dispensary, and they are placed before the profession as presenting a correct description of the symptoms generally present in the unfortunate men who have the misfortune to be suffering from the Sheffield grinders' disease. The case of the girl from the hair-seating manufactory is recorded, because I have found many of the symptoms present in grinders' disease in those who labour in rooms filled with dust.

The *post mortem* appearances present in the lungs of those who have died from the Sheffield grinders' disease, and the treatment which I have found the most efficacious, are described in the next section.

D. POST MORTEM APPEARANCES.

It remains to consider, lastly, in this section, the *post mortem* appearances presented by the lungs of those who have died from the Sheffield grinders' disease: I purpose making, also, a few observations on its treatment.

(b) *The post mortem appearances found in the lungs of those who have died from the Sheffield grinders' disease.*

CASE IX. George Capper, aged 45, a razor grinder, was admitted at the Sheffield Public Dispensary, October 19th, 1855. He complained of difficulty of breathing, tightness over his chest, and some pain on the left side. He said he had worked

at his trade since he was twelve years old. His father, a table-blade striker, died at the advanced age of 82; his mother died at 62. He was one of a family of twelve. "He could not remember that any of his relations had died from consumption, but they might have done, for anything he knew." He had led a very irregular life, had never been married, and had always been very intemperate. He was a good deal emaciated. He measured only five feet; his chest was thirty inches in circumference; and there was much less mobility on the left than on the right side. The respiration on both sides was unequal, and the expiratory murmur was prolonged. There was considerable dulness under both clavicles; he was very sallow; the stools were white; and the urine was high coloured.

A small blister was applied under each clavicle; he was ordered, during the day, an expectorant mixture; and he took, for ten nights, two pills consisting of a grain of ipecacuanha, two grains of blue pill, and six grains of the extract of taraxacum. Under this treatment, he rapidly improved; and he was desired to go into the country, and to take a dessert-spoonful of cod-liver oil three times a day, and to apply the croton oil liniment to his chest until the usual eruption was produced; and, as this died away, the embrocation was to be repeated, so that the skin might be kept more or less sore for six weeks. He was also ordered eight grains of the compound ipecacuanha pill every night, a good diet, and a pint of beer daily. He recovered sufficiently to resume his calling of a razor grinder; and twelve months elapsed before I again saw him. When he was again admitted, the disease had made rapid progress. I saw him again three months before he died. There was then great dulness under each clavicle; the respiration over those portions of the chest where it could be heard was hard and unequal; and a diffused blowing sound could be detected on the right side, below the nipple. Once or twice, on urging him to take as deep an inspiration as he possibly could, an interstitial creaking sound was produced. During the very cold weather we had at

the end of January in the present year, he was attacked with pain in the left side, and with very great difficulty of breathing: he did not apply to any medical man for assistance, and he died on the 28th of January, 1857.

POST MORTEM EXAMINATION, made twenty-four hours after death, with the assistance of my friend and colleague, Mr. George Atkin. The body was considerably emaciated, but not so much as might have been expected in one who had for so many years been ill. On opening the chest, the lungs did not collapse, and there were evidences on the left side of the recent attack of acute pleuro-pneumonia which had proved fatal. Here the adhesions were easily broken down, and evidently but recent. The left cavity of the chest contained a few ounces of serum, and the pleura covering the lung in the same situation was coated with recently effused lymph. The middle lobe of the left lung was in a state of red hepatitis. On both sides there were extensive adhesions; these formed, at the apex of each lung, a cartilaginous cap, from which it was impossible to detach the lungs entire. The whole of the superior lobe of both lungs was extremely dense, and of a black grey colour. The external surface was sprinkled over with small black spots; some as small as a large shot-corn, others as large in circumference as a sixpence. On cutting into the solidified lung—a task of no little difficulty—we observed similar bodies: here and there these were aggregated into masses of a large size; one near the bifurcation of the trachea, on the left side, was the size of a large egg. The bronchial glands were enlarged and blackened; several of them contained a good deal of gritty matter.

In the following woodcut, made from a drawing by Mr. Tuffen West, Mr. Orrin Smith has enabled me to present the exact appearances exhibited by a section of the superior lobe of the right lung of this man.

The peculiar dark spots, to which reference has already been made, will be seen at *a*; the white appearance seen at *b* is also

evidently a result of chronic inflammation ; enlarged bronchial tubes will be noticed at *c*.

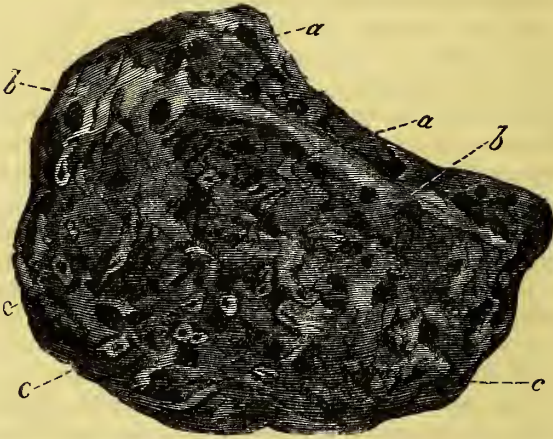


Fig. 3. Section of the lung of a razor grinder.

The *post mortem* appearances of the bronchial glands were exactly similar to those seen in Fig. 4. It was sketched by Dr. Branson, from one of the bronchial glands of a grinder who had died in the Sheffield General Infirmary ; and I am

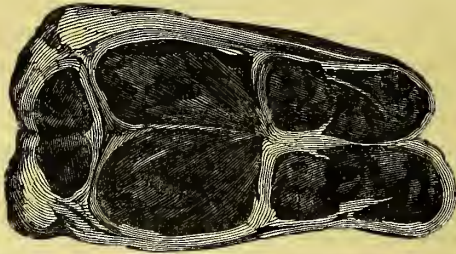


Fig. 4. Appearances frequently present in the bronchial glands of those who have died from the grinders' disease.

indebted to my friend Henry Jackson, Esq., F.R.C.S., the senior surgeon of that institution, for the use of the drawing from which the annexed woodcut has been taken.

The heart was slightly enlarged; valves normal. The other organs of the body were not examined; permission having only been given to open the chest.

Microscopic Examination of the Lungs. I examined various portions of the lungs of this razor grinder, with very great care; and, although several gritty particles could be detected, I did not discover a trace of steel.

The general appearances of each section when examined, even with a very high power, were only such as might be expected in any ordinary case of chronic inflammation. In a case of such importance, however, I wished that, in addition to my own observations, my fellow Associates should have the benefit of the opinions of some of the first microscopists of the day. I accordingly sent a section to my friend Professor Bennett, of Edinburgh, and another section to my friend Dr. Lionel Beale. Dr. Bennett discovered for the most part "chronic exudation tinged with pigment", and fully agreed with me as to the nature of the lesion. Dr. Beale writes: "My impression is that the black granular matter is situated in the smaller bronchial tubes upon the mucous membrane. Much of it is certainly contained within cells; or, perhaps, more correctly speaking, is aggregated into masses having all the characters of cells. At the same time, I think it very likely that some of it is in the vessels, and consists, as you suggest, of altered blood."

I am again indebted to my friends, Dr. Branson and Mr. Henry Jackson, for the use of the beautiful drawings whence the next two woodcuts have been taken.

The next engraving very accurately represents the appearances frequently seen in the lungs of those who have died from the grinders' disease. We observe that portions of the lung are infiltrated with toughly solid exudation, in the state of

induration matter. When cut, portions of it resemble new India-rubber in colour, and they are quite as tough and difficult to cut.



Fig. 5. Section of the lung of a fork grinder.

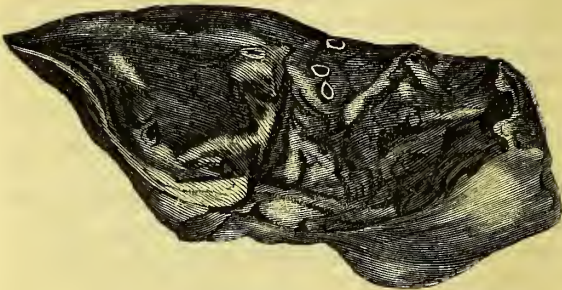


Fig. 6. Section of the lung of grinder.

² Of the general appearances observed in the lungs of those

who perish from this disease, Mr. Orrin Smith's skill has enabled me to present, in this series of engravings, a very correct representation. We observe:—

1. The little black spots on the surface and throughout the substance of the lungs.
2. Dilatation of the bronchial tubes.
3. Enlargement of the bronchial glands. On making a section, they are often seen, as in Fig. 4, of a greyish and blackish colour; for the most part of a very firm consistence. In other cases, they are soft. Calcareous matter is often present in them.
4. Large masses, varying in size and in colour, in different portions of the lungs.
5. Adhesion of the pleuræ.
6. Inflammation of the lining membrane of the bronchi, trachea, and larynx.
7. Frequent enlargement of the heart, disease of the liver, and a granular condition of the kidneys.

These *post mortem* appearances naturally suggest a few observations, which, remembering, as I do, the great length to which these articles have already extended, shall be condensed as much as possible.

1. *The black spots on the surface and throughout the substance of the lungs.* It may be well to remember, in considering the question of exudation in the lungs, that since the beautiful injections of Adriani and of Rossignol it has been known that the bronchial arteries and veins may be filled from the pulmonary veins, and the latter again from the bronchial arteries; the intercommunication of the two systems is thus demonstrated, and we have been thereby taught how disturbances of the circulation in one system, may account for those which are witnessed in the other.

Andral has remarked, “that black discoloration of the lung with augmentation of its consistence, is nothing more, in a great number of cases, than black pulmonary matter, with the superaddition of a morbid induration wholly independent of it. In other words, the lung affected with chronic induration blackens in the same way that an intestine does that is simi-

larly affected, and passes by degrees from red to brown, and even to the black colour."

The same distinguished pathologist speaks also of four forms of melanosis; 1, Masses, incysted or not; 2, Infiltrated in different tissues; 3, Layers on the unattached surface of membranous organs; 4, Liquid. The fourth form was rejected by Laennec, who regarded melanosis as a tissue. These masses in the Sheffield grinders vary in size; some are about the bulk of a small bean; some are about the size of a large egg. I would remark, however, that much of the induration observed in the lungs of the grinders does not depend on the melanotic deposition, but simply on chronic inflammation. With regard to the colour of chronic induration it is sometimes red, yellow, iron grey, brownish, or black. The colour is in some degree of an accidental character, dependent as it is on the presence, in variable proportions, of blood, and of black or dark blue pulmonary matter. Dr. Gregory, of Edinburgh, found the black lungs of a collier to contain coal, which, on destructive analysis, yielded carburetted hydrogen and the other usual products.

In the section of lungs from which fig. 3 was taken, some of the vessels were pervious and the arrangement of the capillaries natural. The walls of the air-cells were thicker, and the elastic fibres more abundant than in a perfectly healthy condition of the lung. In many reptiles which have been kept without food, and with insufficiency of air, the vessels of the lungs and other organs are found to contain similar dark matter.

2. *The enlargement of the bronchial glands* is clearly the result of the chronic inflammation which has been set up in the pulmonary tissue by which they are surrounded. The black pigment which is so often found in them in considerable quantity (fig. 4) does not, so far as I am aware, differ from that generally found in the pulmonary parenchyma. That it bears (as Dr. Sieveking has shown) a close relation to the defective oxygenation of the blood, is manifest from the normal tendency to the deposit being greater in proportion to the advance of life; and, in the attacks of chronic inflammation to which the Sheffield grinders are so liable, it evidently accumulates in considerable quantities.

3. *The cartilaginous capsule* at the apex of the lungs on

both sides is by no means an unusual occurrence. When placed under the microscope the deposit was found to be of a fibrous or, as Lebert has termed it, chondroid character. If the result of former inflammation of the pleura, it involves the free surfaces of the membrane with which it closely combines, which was the case here; if arising from subserous congestion, it is found in the subserous tissues and in the membrane itself.

The whole question of chronic pneumonia and its results, including hypertrophy of the intervesicular tissue, owing, probably, to a deposit in them of an albuminous character, involves considerations of the highest importance, and demands a careful and patient investigation.

Dr. Williams mentions, in his *Principles of Medicine*, a chronic form of pneumonia in which the hepatised portion, owing to the thickening of individual vesicles, assumes an oolitic aspect. In this form of pneumonia he is of opinion that thoracic consumption may commence without the pre-existence of tuberculous disease.

(c.) *Treatment of the Sheffield Grinders' Disease.* This disease requires to be treated on general principles. All causes of irritation must be removed, attacks of inflammation must be subdued as they arise, and every care should at all times be taken to keep up the strength of the patient.

The Sheffield grinders' disease, in the first instance, is simply bronchitis, arising from the irritation produced by the presence of fine particles of stone and metal in the tubes. Removal for a time from the wheel, and a residence in the country, at least during the early stages of the disease, is an essential step to be taken; and the man should resolve for the future to work only in a hull where the revolving fan properly adjusted carries off the greater portion of the irritating particles.

In a grinder somewhat advanced in years, and in whom the disease has made considerable progress, when, in addition to dilatation of the bronchi, the surrounding portion of the lung is not only condensed by pressure, but very often also locally consolidated by chronic pneumonia, it often happens that an acute attack of bronchitis supervenes on the chronic disease. Such a case requires to be treated with the greatest possible caution. The patient, under such circumstances, broken down in constitution, does not die from the inflammation, but from

the large accumulation of mucopurulent secretion thrown out by a congested surface. This copious secretion, which the patient has not sufficient strength to throw off, is the cause of death, the brain and tissues becoming poisoned by venous blood. Strong stimulating embrocations are here required to the chest, and doses of the sesquicarbonate of ammonia and of chloric ether should be given at short intervals.

With regard to the treatment of the chronic form of bronchitis, so common amongst the grinders of Sheffield, much will depend on the peculiar complications each case presents. The addition of a dilated state of the tubes to chronic inflammation of their mucous membrane, adds much to the difficulties of treating with success a patient so affected. In the great majority of such cases that I have seen, both in private and dispensary practice, the sputa have been very abundant, solid, opaque, and, for the most part, purulent. The face is bloated, the lips are blue, the countenance is generally livid; such symptoms arise from the altered state of the mucous membrane preventing the proper aëration of the blood. When the disease is of long standing, it is not uncommon to find enlargement and thickening of the right ventricle.

Blisters applied to different parts of the chest at intervals, and repeated dry cupping, are useful in many cases. In the chronic forms, counter-irritation, especially with the croton oil, or the turpentine and strong acetic acid liniments, should always be employed. The expectorant medicines to be selected must depend upon the condition of the discharge from the bronchial tubes. When the expectoration is excessive, balsam of copaiba and pyroxylic spirit are medicines of considerable value; and the inhalation of the vapour of tar, or of creasote, or of chlorine, much diluted, has unquestionably a tendency to reduce the irritability of the mucous membrane, and to lessen the quantity of its secretion.

